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Research Report

EXPLORATION OF THE UTILITY OF MILITARY MAN

IN SPACE IN THE YEAR 2025

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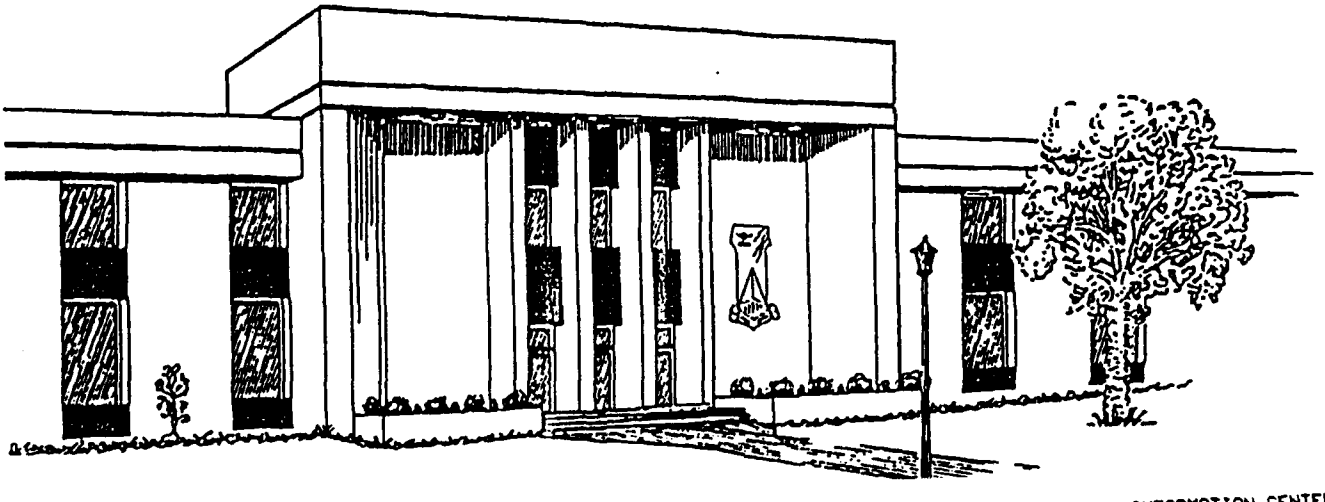

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EXPLORATION OF THE UTILITY OF MILITARY MAN IN SPACE IN THE YEAR 2025

by

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Man in space has been the "center of gravity of the U.S. space program ever since NASA astronaut Alan B. Shepard, Jr. became the first American in space 5 May 1961. (1:1:794) In contrast, U.S. military man in space has not enjoyed the same prominence over the 30 year period. The future of military man in space, if any, is ultimately dependent on the nature of military operations in space. The intent of this research is to show that there are compelling reasons for a military manned presence in space projected to the year 2025.

In order to credibly argue the case for military manned systems, it would be wise to first review the circumstances and events leading to the present state of military manned presence in space and military space doctrine. Second, a review of current military space doctrine will reveal a solid foundation with a clear vision of the future and yet will show there are specific requirements that can not be met by existing space forces. The plan being developed to utilize unmanned space systems to overcome the existing shortcomings will be discussed briefly. The argument of man versus machine or manned systems versus unmanned systems will be investigated to determine what type of systems are best utilized in space. A discussion of the reasons behind DOD's present mindset against using manned systems will reveal that there are no longer any logical reasons not to deploy manned systems, and it will be submitted that the unfulfilled doctrinal

requirements should logically be completed by manned systems. Present Soviet space doctrine and military use of space will be reviewed for comparison with U.S. space policy, specifically focusing on the manned aspects of their programs.

After reviewing the present state of our space programs, some assumptions will be made in order to conceptually examine the future of military manned missions in space projected to 2025. In doing so, the "mission envelope" of military man in space can be envisioned and the examination of concepts should provide insights into the essential requirements and compelling reasons for a military manned presence in space. Finally, recommendations are subsequently proposed for the best utilization of military man in space to meet the warfighting requirements envisioned in 21st century space.

The first attempt at deploying military man in space involved the DOD Dyna-Soar Program of 1963. Six military pilots were chosen as candidates to fly the X-20 to demonstrate control of the return of man from space. The program was cancelled in 1964 without completing any flights because the system was unable to determine the utility of man in space. (2:7)

The next program to determine man's utility in potential military missions in space was the Manned Orbiting Laboratory (MOL) of 1963. Additional objectives were to

develop and experiment with new technology and equipment. MOL was cancelled in 1969 before making any flights and 7 out of 17 selected pilots eventually flew in space after they transferred to NASA as astronauts. Termination of the program was due to cost and a decision that most space missions at the time were better performed by automated instruments or by earth based assets. (3:7)

The most recent program started in 1979 with the manned spaceflight engineers or MSE's who had been selected to assist in the development of military payloads and to fly with them as payload specialists on Shuttle. The first actual "military man" mission was completed by Major Gary Payton in January 1985. One more "military man" flight was completed soon after for a grand total of 2 out of 32 selected MSE's to actually fly in space. A handful of engineers remain on with the Air Force Space Division and one, possibly two, is expected to fly on the Shuttle by 1992. (4:6-8) The main reasons for the non-utilization were a significant decrease in DOD military payloads after the Challenger accident and a realization that the NASA mission specialists were, for the most part, able to deploy the military payloads and experiments just as effectively as the MSE payload specialists. (5:8)

During the same time period the remaining MSE payload specialists transferred into the Military Man in Space (MMIS) Program and are currently under the auspices of

the Space Test Program (STP) Office. The STP presently schedules all DOD payloads and experiments flying on all available launch vehicles. (6:a) The first dedicated payload specialist (PS) of the MMIS Program completed a successful mission in December 1991 on Shuttle Atlantis STS-44 in support of the Army's Terra Scout experiment to demonstrate surveillance of military targets and activities on earth from space by a military astronaut. (7:10) The majority of remaining DOD MMIS payloads, however, are experiments scheduled to fly on Shuttle without a need for dedicated payload specialists. Again, the NASA mission specialists were able to fulfill most of the payload monitoring requirements. Thus, the present state of military man in space has been relegated to the noble and yet uninspiring and limited missions of intelligence gathering through surveillance, completing technical experiments and advanced spaceborne research. The majority of the research rarely requires a military manned presence that couldn't be accomplished by civilian astronauts or unmanned instruments and sensors.

The reasons leading to the present non-utilization of military man in space are fairly basic in nature and center on political and practical limitations. U.S. military space doctrine identifies and shapes the nature of military operations in space in support of national security policies and defined mission elements. Until recently, the national

security policies and mission elements for space were ill defined and supporting military space doctrine had little guidance. (8:1) In the sixties and seventies, national policy initially focused primarily on the "sanctuary" aspect of using space for peaceful purposes to benefit mankind. This was never officially published and yet it governed the employment of space forces. (9:3:33) The American public supported the sanctuary concept and readily identified with the newly formed NASA as the leading civilian force in space exploration. At the same time, military use of space was promoted as long as the activities served peaceful ends. The Outer Space Treaty, the Treaty Banning Nuclear Tests in Atmosphere, Space and Underwater, and the ABM Treaty were then and are still the main limitations imposed on warfighting and weapons in space. (10:C:173-189) Military space doctrine during this period was basically a non-doctrine that supported the sanctuary based national space policy and objectives by allowing only surveillance systems for treaty verification overflights in space. (11:3:35) Man in space, under the civilian space program run by NASA, achieved the pinnacle of success with the Apollo programs leading to a lunar landing and the follow-on Skylab Program. (12:178) Military man in space programs, as noted earlier, were destined to follow the military space doctrine, or non-doctrine, of the times.

Basic military doctrine for space did not mature into a cohesive written form until 1982 with AFM 1-6, Military Space Doctrine and Air Force Manual (AFM) 1-1, Basic Aerospace Doctrine of the United States Air Force, published in 1984. (13:29) Initial attempts to define elements of military space doctrine concentrated on deterrence and survivability of space assets in support of a national space policy starting to move away from "sanctuary" space with the Strategic Defense Initiative (SDI). (14:1-1) The goal of SDI was to replace strategic offensive nuclear deterrence with a defensive strategy using advanced technology. Survivability of space assets was to be accomplished with anti-satellite technology (ASAT) and a more robust satellite reconstruction capability. Neither element required the services of military man in space.

As stated earlier, up to 1988 the national space policies were ill-defined to the detriment of military space doctrine. This was rectified by the national space policy of 1988 which focused on a combination "survivability" and "space control" strategy. This was a direct result of the Challenger accident and proposed the concept of "assured access" which restructured U.S. launch infrastructure to include external launch vehicles (ELV's) under DOD control in addition to Shuttle. The space control strategy demanded freedom of action for DOD systems to include offensive ASAT deployment in support of terrestrial forces but still

allowed limited enemy access to space for overflights to preclude escalation (15:15)

The comprehensive national space policy issued November 1989 by President Bush clearly defined the nation's new space policy and goals and is now the guidance for current military space doctrine. The 1989 policy concentrated even more on "space control" and developing the ready capability for space force application in support of ground forces. (16:9-14) The Gulf War and the recent decline of the Soviet Union brought about changes in the SDI with the emerging preeminence of the Global Protection Against Limited Strike or GPAL's system and a final realization of the critical strategic and tactical importance of space systems to terrestrial forces. (17:5)

Military space doctrine is currently published in a September 1991 draft version of AFM 1-1 mentioned earlier (18:1), AFM 2-25 Space Operations initial draft dated 29 March 1991 (19:1), USSPACECOM PAMPHLET 2-1 Doctrine for Space Control Forces dated 27 March 1990 (20:1), and JOINT PUB 3-14 Doctrine for Joint Space Operations draft outline in progress October 1991. (21:1) The specific goals and missions defined in the 1989 national space policy are the primary focus of all the above doctrinal publications. They are all in a revision process to reflect the emphasis on protecting our space assets in order to support terrestrial

warfare and to provide doctrine meaningful to terrestrial warfighters as well as space operators.

National space policy specifies four mission elements for the national security space sector (DOD space forces) of space control, force application, space support, and force enhancement. (22:13) These mission elements are relisted in AFM 1-1 as broad purpose roles of aerospace power which are matched up with typical missions. (23:7) USSSPACECOM PAMPHLET 2-1 concentrates on developing concepts for space control and does not address space support and force enhancement. (24:2) AFM 2-25 follows on nicely from AFM 1-1 and includes the four broad purpose roles and associated missions with broad guidance on employment of space forces to accomplish those roles and missions. (25:15-20) The most recent draft outline of JOINT PUB 3-14 continues listing the four mission elements as military space functions. The four military space functions will be specifically linked to military space operations in Chapter Three in an attempt to fully integrate space combat capabilities with terrestrial combat operations. (26:8) The space function of force application is linked with space fire support operations of offensive and defensive fires, probably with strategic weapons. The space function of space control is linked with counterspace operations (CSO) of integrated offensive and defensive operations, passive and active CSO, and counterspace counter measures. (27:10-

11) The JOINT PUB also reiterates and emphasizes the need for a robust launch capability for assured access to space and an on-orbit sparing for reconstitution capability.

All of the space doctrinal publications are attempting to look into the future in anticipation of new technologies and capabilities. This is evident by the references to strategic weapons for space fire support and offensive space systems for counterspace operations. These references also imply future conflict in space is inevitable and will not be constrained by policy. The publications mention policy constraints but are written as if they are unconstrained. Today's military space doctrine publications are all based on sound principles of warfare and reflect far reaching, yet logical thought in envisioning the space battlefield of the future. For the first time, military space doctrine has risen above the constraints imposed by technology, economics, and politics, and has acknowledged the following words of wisdom:

> "National safety would be endangered by an Air Force whose doctrines and techniques are tied solely on the equipment and process of the moment. Present equipment is but a step in progress, and any Air Force which does not keep its doctrines ahead of its equipment, and its vision far into the future, can only delude the nation into a false sense of security.
>
> General H.H. "Hap" Arnold (1945)

Recent critical reviews of current military space doctrine have indicated there are specific requirements set forth by national space policy that presently can not be met by existing space forces. General John Piotrowski stated in the foreword comments of USSSPACECOM PAMPHLET 2-1 Doctrine For Space Control that "the requirement for space controls not met due to the lack of space control forces." (28:i) Major General Robert Rankine, former Vice Commander of Air Force Space Division early identified and expressed serious concern over little to no launch infrastructure resiliency to support on-orbit reconstitution in his 1988 Space Issues Symposium article. (29:54)

Implementation of present space doctrine is accomplished with existing ground support infrastructure and spaceborne systems with the exception of not having an ASAT capability. This is a serious disadvantage should armed conflict extend into space and U.S. space assets come under attack. The present launch infra-structure and on-orbit satellite spares for reconstitution called for by current doctrine are inadequate at best. As it stands to date, it would be very difficult for U.S. space forces to accomplish the national security mission elements of space control and force application specified in national space policy.

The DOD solution to correct this serious defense deficit is a renewed emphasis on achieving an ASAT capability and the development of a National Launch System,

thus turning again to unmanned spaceborne technology controlled from earth. (30:41) The logic driving the decision for utilization of unmanned systems has long been a subject of debate for DOD. The Air Force Space Command studied the utility of man versus machine in space in December 1985 to determine strengths and weaknesses for various missions. The expert panel was unconstrained by political, economical, or legal restrictions and analyzed only pure military potential in space. Not surprisingly, the panel identified missions of space control and force application as being accomplished much better by man and his unique abilities than by machine. Specifically, counterspace operations, space interdiction and strategic offensive and defensive operations were cited as having the most promise for manned systems vice unmanned systems due to man's innate ability to reason, apply judgement, react and adapt, take independent action and display initiative. (31:54-55) These compelling conclusions make sense and are still valid today. Logic dictates that manned systems should be pursued where the potential is highest. (32:54)

Today's space forces have been identified as having serious deficiencies in being able to implement military space doctrine functions of counterspace operations and strategic offensive and defensive operations. It is obvious that the most logical solution would be to utilize manned systems to correct the implementation deficiencies of

today's doctrine. Why, then, has thee been no commitment to date by DOD to utilize military manned systems?

A summary of the evidence to date suggests that DOD has been reluctant to utilize military manned systems for two basic reasons, mission and money. To amplify, the efficient utilization of man in space depends on the mission to be accomplished which depends on military space doctrine derived from national space policy. Prior to 1988, DOD could see no mission for military man in space that couldn't be accomplished just as well by unmanned systems and therefore, less cost. Today's doctrine requires missions of space control and force application that were logically shown to be accomplished better by man in space, thus mission is no longer a valid excuse for DOD not to utilize military man in space.

The second reason for money is proposed due to the exorbitant cost of life support technology required for manned missions. The basic life support technology that is still quite sufficient for present day missions has been in place since the sixties and the advanced technology to support long duration missions is rapidly being developed. Military man in space will also require a robust living environment to conduct combat from and it is submitted that the advanced technology to produce such an environment will soon be attained. This is supported by Collins in his 1989 book on military space forces:

> "Science and technology are twin keys in future space capabilities, but hard to forecast. Pundits who insist that any technology problem is insolvable have repeatedly been proven wrong." (33:50)

Basically, it becomes a matter of choice between the more expensive manned systems or the less expensive unmanned systems and is a function of the mission to be completed. DOD decisions prior to 1988 doctrine were all logical since the less expensive unmanned systems could effectively complete all missions. Since 1988, however, the decisions for unmanned systems have clearly been driven by economic constraints where the missions to be supported are space control and force application. Should this trend continue, the U.S. will not have the capability to accomplish these national security mission elements as directed by national space policy.

Having looked at U.S. space programs, it would be wise to assess present-day Soviet space programs as a comparison, and to particularly look at how they view their substantial military manned space programs. On 12 April, 1961, Soviet cosmonaut Yuri Gagarin became the first human to leave the earth's gravitation field, thus beginning the space age. Three decades have passed since then and the Soviets have continuously increased their number of space launches annually, reaching a peak of 90 or more launches per year from 1980 through 1988. The drop in launches down

to 59 in 1991 was probably due to relaxed tensions with the United States. (34:29)

The sheer magnitude of the Soviet manned space effort is most impressive as Soviet cosmonauts have compiled over 4,100 cumulative man-days in space thru 1985 in comparison with 1,600 U.S. man-days. The Soviets had 808 days of consecutive manning of the Mir space station from February 1987 to April 1989. (35:22) Soviet cosmonauts recently accumulated 18,658 hours in space during 1991, almost three times the 6,351 hours that U.S. astronauts spent in space. They also spent more than 64 hours in space walks outside the Mir space station in 1991 as compared to 21 hours in space walks for U.S. astronauts. (36:29) This was all being accomplished during the political upheaval in the Soviet Union in 1991, including an attempted overthrow of the Soviet president, the complete dissolution of the Soviet communist party, and the formation of the new Commonwealth of Independent States, all of which obviously had little to no effect on Soviet military space activities. The Minsk Accord was signed December 1991 by all but two independent Soviet states and by March 1992 will probably be signed by all of the states, including Ukraine. This agreement calls for sharing the cost of the space effort, an interstate space council, profit sharing, a guarantee for the republics to conduct their own additional space programs, a guarantee of non-interference in space launches,

and is viewed as an overall unifying force for the commonwealth. (37:20)

The Soviet manned space program was assessed by Secretary of Defense Cheney in September 1990 as being heavily military with a basic objective in outer space to attain military superiority in that environment. Cheney viewed the Soviets as staunch believers in exploiting all facets of science and operations in space through their military cosmonauts in orbit to achieve Soviet military objectives in space. (38:22) Cheney was certain that the Soviets were acquiring vital experience in operating continuously manned outposts in orbit and the manner in which human beings, using wisdom, intuition, flexibility and foresight, can be applied to accomplish military, scientific, and civil missions in space. (39:22)

With the recent changes in the former Soviet Union mentioned earlier, there now appears to be a definite change in Soviet mindset. They no longer appear to view military superiority in space as their paramount objective, mostly due to the massive collapse of their economy. The Minsk agreement should ensure the future security of Soviet space programs but now with more emphasis on non-military space roles and missions. What the U.S. should do is to take advantage of the lessons learned by the Soviets in regards to their vast, successful experience in manned space programs and to follow suit with manned space systems as a

priority for future U.S. space endeavors. When asked what kind of spacecraft, either unmanned or manned, offers better prospects for space exploration and exploitation, key Soviet space scientists and cosmonauts responded with one voice. They all agreed that when it is necessary to display a creative approach or intuition, or to rely on experiences, unmanned automatic devices can never compete with man. They have proven through hard won experience that in space the best performance in operations, research, and experiments can be achieved by an optimal combination of automatic devices with human abilities. (40:129)

An accurate prediction of military man's "mission envelope" in space projected to 2025 can be accomplished if a few assumptions are made to provide us with conceptual requirements for a military manned presence in space. Present day space doctrine focuses on space control with a high probability that force application in space will be necessary. That probability will increase as military and civilian sectors experience an increased reliance on space based assets. This is especially true for the military as they draw down to a smaller force which will require significantly more space support. Civilian exploitation of space for economic gain is a logical progression as civilian manned industrial facilities are launched into orbit. This will increase the need for direct spaceborne protection that can only be judiciously provided by military manned space

systems. The present concerted effort to reduce superpower nuclear arsenals will not reduce the need for national means of weapons verification and it will continue to be a priority mission well into the future. (41:1) When this is combined with an increasing number of space capable nations, the odds of interspace conflict occurring are significantly increased. Military manned systems will ultimately be required in the future space environment should interspace conflict occur in the form of a rival nation with manned space forces deciding to exercise national will with their space control capabilities. In time of conflict, the legal and political constraints currently in effect are proven by past wars to be basically disregarded by both adversaries and logic would suggest it will be no different in space. Thus the assumption is made that the foundations of present day military space doctrine will be applicable in 2025. In addition, the second assumption is that intrinsic legal and political constraints will not be considered. In doing so, the mission envelope of 2025 can be viewed from a purely military aspect and not be limited by present day conventions.

The above discussion warrants further attempts to discern additional compelling reasons for DOD to utilize military man in space. The intrinsic economic constraints presently imposed on DOD by a restricted space budget has not constrained their doctrine, so why should they let it

constrain implementation of their doctrine? The time to commit to military manned space systems to most effectively implement space combat missions is now, and DOD must realize that military man in the loop is essential to present day and future military missions in space. This is strongly reinforced in the comprehensive follow up report on the status of the U.S. Space Program completed by the Augustine commission in July 1991. (42:8) The report focused primarily on the critical need for a continued manned presence in space and drew the conclusion that man's innate ability to apply his intellect and judgement cannot be equaled by unmanned technology.

Another critical reason for military man in space will be to respond to a military chain of command on national security matters and in time of crisis requiring combat and use of weapons. As noted earlier, military man in space will be assigned the combat mission element of space control including counterspace operations and space interdiction and the combat mission element of force application including strategic offense and strategic defense. Additionally, he may be assigned the mission element of space support including on-orbit control and the support mission element of force enhancement including reconnaissance. The major criteria for the assignments is to choose the mission elements that man can do better than machine. Therefore, the third important assumption is that

military man in the loop will be essential to military missions in space in 2025.

Since military man is assumed to be essential in space, then it follows that a steady supply of trained military astronauts operating military space systems with military ground support would be a necessity. Thus, a fourth assumption is that there will be two parallel space programs, a civilian program probably run by NASA concentrating on space research and exploration, and a military program run by DOD concentrating on accomplishing national security goals in space.

To further predict military man's space role in 2025, the fifth assumption is that intrinsic economic constraints will not be considered. This is based on the fact that present day scarcity of defense dollars is undermining national space policy and severely limits DOD's range of feasible options in space to the point of being counterproductive. Economic constraints are usually the driving factors behind selection and development of space systems and unfortunately, by the time conflict begins it is usually too late to change or develop different selected systems. Presently, dollars dictate logic and the compelling reasons for deploying military man in space are being disregarded. It is submitted that if these space combat missions approach critical states and are not being accomplished effectively then funding for manned systems

will be no object. As presented earlier, since there will be an increased probability of crisis related force application in space occurring, then it is reasonable to assume that funding to support military manned space systems in 2025 will not be a constraint.

These assumptions can be combined to provide us with a conceptual view of the space environment of 2025 and how military man will be utilized. The argument of the viability of manned space systems over unmanned systems for combat roles in space has been presented and the same contentions can be made for the space requirements of 2025 as for present day requirements. The 2025 mission envelope for military man in space will be concentrated primarily on the combat mission elements of space control and force application. Combat oriented space systems or platforms controlled by military man will be used tactically and strategically in the most advantageous areas in space to accomplish the missions. To have a role in future space, military man must have space systems to operate in. One of the more compelling reasons for future utilization of military manned systems in lieu of unmanned systems is that the intriguing advance technologies and resulting space systems coming available in the immediate future will require manned control to be most effective. Descriptions of the most promising upcoming space systems and their

capabilities are presented to provide us a view of future military manned space missions.

The national aerospace plane (NASP) is currently in research and development under NASA and DOD Programs. Designated the X-30, it is basically an all weather, fully reusable spacecraft capable of launching horizontally from any runway surface, transitioning through the atmosphere, maneuvering in and out of earth orbit and reentering the atmosphere for conventional runway landing. (43:32)

Classified as a medium lift vehicle (MLV), the NASP will be reusable with a short turnaround time for launch from earth into low earth orbit (LEO) followed by atmospheric reentry to a powered landing. The spacecraft will provide a quick launch capability for military tactical and strategic missions of space control and force application. NASP will provide quick access to orbit with a top speed of MACH 25 by combining current ramjet technology with a slush-hydrogen fuel driven scramjet and pure rocket engine technology (44:33) It will be able to deliver a 25,000 pound payload to LEO in its cargo bay for 3% of the cost of one Shuttle launch.

NASP research and development was fully funded in FY91 for NASA and DOD partially funded in FY92 for NASA only. (45:18) The major stumbling block has been in developing an atmosphere engine or combo of engines that can smoothly transition the airflow required to attain MACH 15

and can endure extreme temperatures. However, the former Soviet Union has recently claimed they have completed a successful test flight of a hydrogen-fueled scramjet engine in late November 1991. According to Soviet officials, a missile-like vehicle was accelerated to six times the speed of sound by a ramjet using an unprecedented combustion of hydrogen and air at supersonic speeds. (46:3) U.S. NASP prototype demonstration is projected to occur by 1999 with an operational aircraft to follow by 2010. (47:33)

The NASP will be capable of maneuvering while in orbit or in the atmosphere to support strategic and tactical missions of short duration. A NASP armed with state of the art weaponry and flown by military astronauts could launch from the continental U.S. and engage Soviet bombers within 30 minutes while they were still over the North Sea. The capability to fly halfway around the globe in two hours would make it an excellent military reconnaissance or surveillance platform or a logistic troop/cargo transport. Working in and out of the edge of the atmosphere would make it semi-legal under the ABM treaty as an airborne ABM platform or an excellent ASAT platform to protect low earth orbit satellites. Quick access to orbit would allow for reconstitution of satellites during conflict and repair or retrieval if necessary.

The most dramatic use of the NASP would be as a LEO interceptor, air to air combat interceptor or a strategic

bomber to provide space interdiction, counterspace and counterair operations, close air support and battlefield interdiction. (48:32) It is not hard to envision aerospace plane squadrons deploying from all points of the globe in response to conflict in air and space. A final derivative of the NASP would incorporate a vertical takeoff and landing (VTOL) capability as demonstrated today bv the V-22 and AV-8 which would allow for extreme maneuverability of launch and recovery locations.

The compelling reason for deployment of military man on the NASP is not only for the space warfighting capability it can provide, but to be on a equitable basis with rival nations. For example, Japan's Space Activities Commission (SAC) has recently set three priority goals of attaining an aerospace plane capability, developing an indigenous space station, and starting their own manned space program. (49:96) In addition, related research to attain a hypersonic reusable space plane is being pursued by Germany, France, Britain and India. (50:3) Thus a U.S. NASP piloted by military astronauts may have a critical mission for national security to provide a LEO intercept capability against enemy aerospace plane assets in 2025.

Another space vehicle worth promoting for future utilization of military man in lieu of unmanned systems is the "Delta Clipper". It will be a single-stage-to-orbit (SSTO) spacecraft capable of a relatively inexpensive

vertical launch and vertical recovery to and from low earth orbits similar to the lunar lander. (51:38) Using technology derived from SDIO programs and from the NASP program, Delta Clipper research is fully funded through McDonnell Douglas to be prototype by 1993 and into production series by 1998, using aerospike rocket engines with no nozzles that will work at all air pressures. The Clipper will be manned by military astronauts and capable of a low 1.25g liftoff, with payload capacity in the medium launch vehicle (MLV) range. (52:38) Quick turnaround maintenance and minimal ground support infrastructure requirements make it an excellent candidate for quick launch from remote land areas and from sea going platforms similar to today's helicopter carriers and helo capable ships.

The Clipper will be an excellent LEO platform for surveillance, reconnaissance and as a tactical command post during conflict. In addition, after refueling in LEO, it will have the capability to proceed directly to the moon. The minimal cost of launch, estimated at $400 per pound of payload, will make it an excellent space based trainer for military astronauts. McDonnell Douglas is building a one-third scale vehicle that will not be capable of reaching orbit but will be ready for test flight by March 1993. The first full-scale flight version should follow and be ready for flight to orbit by mid 1996. (53:15)

The most dramatic proposed use of the Delta Clipper will be as a vertical quick launch manned weapons platform operated by military man and armed with state of the art laser, particle beam, radio frequency and kinetic kill weapons and inserted into a highly tactical, high inclination orbit similar to Molniya and sun-synchronous orbits. Tactical orbits will support all forms of space interdiction, ASAT combat, strategic and tactical kinetic kill bombing, and ABM capability, all provided on short notice. Additionally, the Clipper would be the ultimate VTOL capable, special forces insertion platform for terrestrial conflict and to support over-the-horizon (OTH) amphibious operations and over-the-atmosphere (OTA) insertion of troops into space if needed.

Space station Freedom has been discussed as not being a suitable military platform for various reasons. A majority of the arguments can be nullified by using a more secure orbit and redesigning the station for purely military missions. The proposal is a dedicated strategic military space platform manned with military astronauts and armed with state of the art weaponry, space based radar, full spectrum imagers, and capable of strategic offense and defense, counterspace operations, force enhancement reconnaissance and C3. The platform would be inserted into geosynchronous orbits with a possible self defense capability of thwarting an enemy intercept weapon by

adjusting its orbit by small increments to slowly maneuver into an adjacent orbit. Using geosynchronous altitudes will increase the time and ability to detect attack and to directly defend geostationary national assets against enemy ASAT attack.

To support long duration manned missions, this geosynchronous platform will need some degree of induced artificial gravity to preclude skeletal calcium depletion and pain related to bone structure lengthening. (54:2) Additionally, the structure will need to be hardened against harmful radiation and against electromagnetic pulse (EMP). Supporting technology to develop a geosynchronous platform will be available from the current National Launch System (NLS), specifically, the heavy launch vehicle (HLV) which will implement the new space transportation main engine with 20% greater thrust than a Shuttle main engine. Alternate launch support could be the Shuttle "C" cargo derivative of the Shuttle. (55:32) The Augustine Commission referenced earlier has recommended funding an HLV vice an additional Shuttle carrier.

The geosynch platform will predominantly be used as a strategic command post capable of locating strategic targets, reconnaissance of mobile launchers, missile warning, observation of ABM testing, weather observation, satellite servicing, command control and communication center, space based training platform, weapons platform and

weapons testing platform. Self-defense will be facilitated by a wide array of short to medium range basic defense weapons and a proclaimed territorial "safe" self-defense zone similar to an aircraft carriers controlled airspace. Long range platform air patrol (PAP) similar to a carrier's combat air patrol (CAP) could be completed by a detachment of organic NASP or possibly Delta Clipper type spacecraft. These spacecraft will also be used as transport vehicles to support logistics to and from the earth, moon, or LEO space station. The NASP spacecraft will sortie from the geosynch base platform as needed to protect geostationary assets by launching ASAT weapons or deploying decoys and chaff. A separate, robust storage capability will also be required to provide extra fuel stores to service the geosynch platform and the tactical spacecraft. Material composition of the geosynch platform may be made up of stealth capable materials currently in development that can reduce sensor image returns. As a final variation, it may be a tactical and strategic advantage to deploy an array of three to five geosynch platforms in various high altitude orbits as needed for mutual support, combined defense and diversification of critical warfighting assets.

The final concept utilizes military man in space as a space system troubleshooter capable of repairing, replacing, or servicing on-orbit satellites, weapon systems and space platforms. Secondary mission will be to implement

a space combat search and rescue (SCSAR) mission in time of conflict. The orbital maneuvering vehicle (OMV) will be the primary spacecraft to support the troubleshooting and rescue missions with a capability to maneuver between orbits ranging from LEO to GEO. (56:49) The OMV technology exists today and could be prototype in the near future if funding is supported. The future proliferation of space assets in 2025 will be of such magnitude that a manned troubleshooting capability in space will be very cost-effective.

The proposed warfighting space systems of: (1) A fleet of quick response, tactical low earth orbit military spacecraft operated by military astronauts launched horizontally and vertically from all points on earth; (2) A geosynchronous array of strategic, manned military command post/weapon platforms capable of deploying tactical spacecraft; and (3) A military manned, dedicated troubleshooting and rescue spacecraft capable of maneuvering between LEO and GEO, all combine to define a mission envelope for military man and provide the warfighting capabilities necessary to achieve national security goals in space by 2025. They also combine to capitalize on the compelling and unique warfighting capabilities of military man by providing secure platforms to fight from in order to achieve superiority during future, inevitable conflicts in space. History strongly suggests that manned weapon systems in a warfare environment will ultimately win out over

unmanned systems and that man in the war environment is essential to achieving parity against an enemy manned presence. Clausewitz supports this theory of friction in war with the following quote: "Everything in war is very simple, but the simplest thing is difficult." (57:119) Couple this suggestion with DOD's present day limited mindset against military manned presence in space and the existing deficit in U.S. space forces to support national security goals, and the stage is set for utter defeat in space should our space assets be put in jeopardy by an enemy capable of projecting hostile men and weapons into space.

In conclusion, it is absolutely essential for the well being of today's space forces as well as the future space forces of 2025, that DOD develop manned advanced technology space systems in lieu of or in addition to unmanned systems to effectively utilize military man's compelling and aggressive warfighting abilities to accomplish the critical wartime mission elements of space control and force application. National space policy, military space doctrine and common sense all dictate they should do so if space superiority during future, inevitable conflict with enemy space forces is the paramount objective. Deploying military man in space will provide that space superiority and he will finally become the "center of gravity" of the U.S. space program.

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